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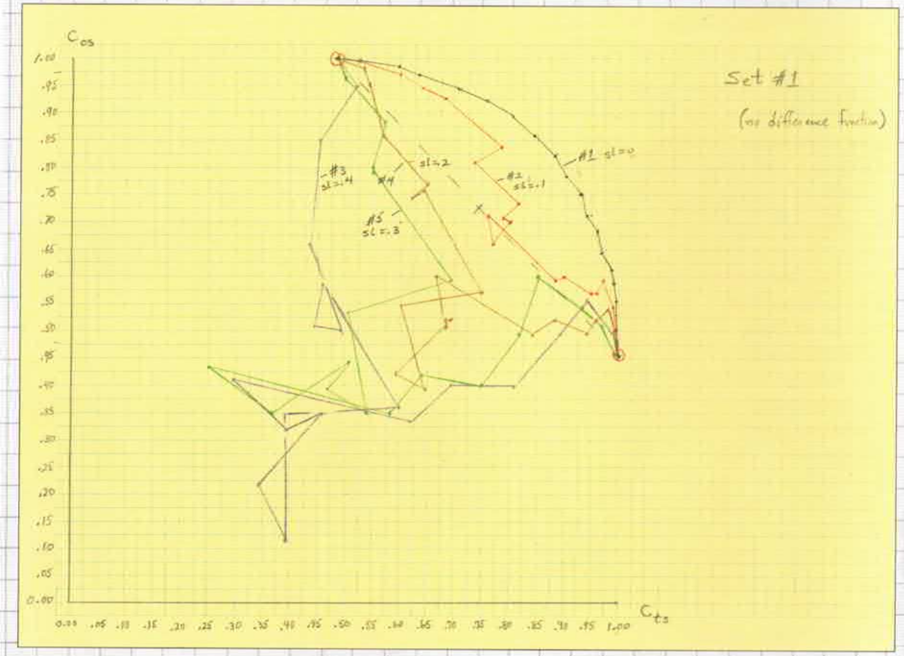

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david rosenboom, composition & electronics

william winant, percussion

Zones of Influence

Program Notes

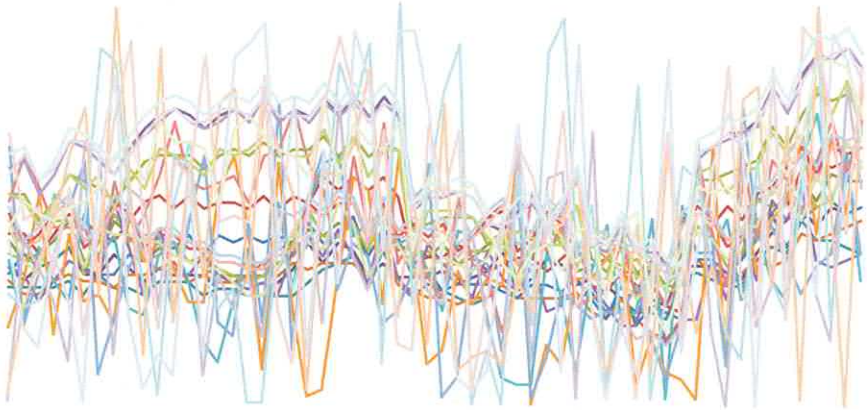
Zones of Influence is a propositional cosmology activated in music. It is an example of *propositional music*, a point of view about composing in which composers might build proposed models of worlds, universes, evolution, brains, consciousness or whole domains of thought and life, and then proceed to make dynamical musical embodiments of these models, inviting us to experience them in spontaneously emerging sonic forms. My process for composing *Zones of Influence* in the early 1980s involved building such models with the idea that once built and embodied in the software of electronic instrumentation, they would be activated by the gloriously unpredictable virtuosity of a master performer. Everything was to be energized in vigorous live performance. So, *the models became instruments.*

Performers in such paradigms often interact with these models via compositional algorithms that generate musical materials, the forms of which result from the *way* they play and *what* they play. The algorithms may also restructure themselves in response to *how* the performer plays. The *what*, in the case of *Zones of Influence*, may include notes, rhythmic structures, melody shapes, melismas and other patterns detected via sensors attached to acoustic, percussion instruments.

The propositional models in *Zones of Influence* explore ideas about evolution and morphogenesis, thresholds of perception crossed when *things* transform themselves into other *things*, the nature of predictability and what it means to *know* something about a physical system and the dynamical nature of catastrophic change. *Zones of influence* is also a term used to describe a region of space surrounding a structure for morphological dynamics, known as a *chreod*. Inside this *zone of influence*, that structure can directly affect other structures, as it might do inside an embryo. Outside the *zone*, it does not.[1]

Among the many elements of musical language heard in the dynamical models of *Zones of Influence*, musical *shapes* are always prominent: shapes heard as melodies, shapes describing changes in speed, space and time, shapes in the microcosms of sound waves and the macro-forms of whole movements, the shapes of transforming functions that bend sound waves and musical forms into new sounds and forms, the shapes of *probability rhythms* that govern likelihoods for things happening and the shapes of glissandi swirling in a counterpoint matrix. All these shapes are related to each other. Most are derived from transformations of just two, freely-composed, 60-note melodies, called the *Origin Melody* and *Target Melody*, which act as musical DNA for the entirety of *Zones of Influence*. All in all, 306 interrelated melodies appear, and every one results from some way of transforming the contours of the *Origin Melody* into those of the *Target* and vice versa. These ways of transforming produce mutated melodies, which are mapped in a multi-dimensional *concept space* showing how *close* (similar) or *far away* (dissimilar) each is perceived to be from the *Origin* and the *Target*. Sets of mutated melodies emerging from particular ways of transforming lie along pathways in this space, called *trajectories*. These trajectories are then treated as higher level shapes in the counterpoint structures of *Zones of Influence*. Shapes upon shapes emerge and intertwine up and down a *holarchy* of musical forms.[2] At the time, I called this process, *morphological mutation*, a new way of making variations.

Some of these trajectories are smooth, with only subtle changes appearing from melody to melody and shape to shape. Some are jagged, with mutated shapes moving far away from and bearing only distant, perceived relatedness to either the *Origin* or *Target*. Eventually, however, they move closer and closer again, exhibiting increasing similarity to one or the other. Finally, this world of shapes led me to construct a *system of counterpoint*, within which the shapes are combined and recombined, like vines or veins intertwining, sharing features that refer to one another or to the *Origin* and *Target*. This sonic recombination produces newly emerging musical entities. I hope that joyful musical explorers, active creative listeners, will find endless discoveries awaiting them in the fabric of this musical space. *Zones of Influence* is, most of all, an invitation to enjoy listening like a pioneer.



All 33 melody lines from the three transformation trafectories heard in Part I of *Zones of Influence, The Winding of a Spring*. The *Origin Melody* is shown by the darkest blue line and the *Target Melody* by the lightest blue line.

Part I: ***The Winding of a Spring***, a) ***The Stochastic Part*** and b) ***The Tripartite Structure***

The Winding of a Spring explores evolutionary pathways between order and disorder expressed in rhythmic patterns and melodic relationships. Along these pathways, our listening space may become warped by perceptual singularities, or musical centers of gravity, around which more and more energy is wound until full capacity is reached.

I had been fascinated for many years by the vast and rich musical language of Scottish rudimental drumming. Today we encounter a greatly simplified descendent in American parade drumming. The source, however, is extraordinary in its complexity and extensive repertoire. *The Winding of a Spring* includes a fixed score for three snare drums (low, medium and high), in which a selection of traditional drumming rudiments appears in endlessly varied forms. The components of these forms are superimposed over one another, like the transparent layers of a "visible human," showing bones, muscles, organs, veins, nerves, and so on. They include the rudiment patterns and their variations, the placement of drumming accents, assignments of the performer's left and right hands to the three snare drums, the number of drum strokes played during each metric unit, dynamics and a *Just* (whole-number ratio) scale of tempo variations for what I call *speed melodies.* In *The Stochastic Part*, the methods for transforming these materials employ probabilities to organize disorder. In *The Tripartite Structure*, a musical scaffolding is built by imbedding patterns inside groups of three within groups of powers of three—(from 3^0 to 3^7 yielding a macro-pattern of 2,187 elements). This ordering is reminiscent of the *mora* in South Indian drumming or the *tehai* in North Indian drumming, which also employ tripartite forms. Here they are carried to extreme in combination with other contemporary percussion techniques.

Each stroke played by the percussionist triggers the propositional model to emit a sound in a three-part counterpoint (with eight-voice polyphony) paralleling the three snare drums. Each part is composed from a set of eleven melodies slowly transforming between the *Origin* and *Target.* The three melody sets differ in the smoothness or jaggedness of their trajectories. The one attached to the lowest drum is the smoothest, and that attached to the highest drum is the most complex. Endless cross-references result from recombining fragments of the 33 melodies with each other. Changes in the sound synthesis engine are activated at specific points in the score and are determined as an aspect of creative orchestration. Except for some stochastic variations that can change from performance to performance, *The Winding of a Spring* is a fixed composition scored in all its details.

Part II: *Closed Attracting Trajectories*, a) *Melody Set 1* and b) *Melody Set 2*

In *Melody Set 1*, I wanted to make a marimba and its rigid bars of wood appear to be singing and to be able to bend and re-shape its phrases and melismas. My solution was real-time signal processing, and this is the only place in *Zones of Influence* where that technique is applied to the acoustic emanations of the percussion. This processing captures resonances in the marimba's melodic intoning and spins off subtle pitch-shifted swirls from its notes. A key thing to know is that in *Melody Set 1* we hear the smoothest trajectory possible of 21 melodies slowly bending from the shapes of the *Origin* into the shapes of the *Target.* We also hear the *Origin* at the beginning and the *Target* at the end, played simply on the unprocessed, solo marimba. The score is written in proportional notation with ornaments and without meter. Here is our most direct experience with the melodic DNA of *Zones of Influence.*

Closed Attracting Trajectories also explores catastrophic changes of state, like those we encounter in nature when one aspect of a phenomenon is gradually varied, like water turning suddenly to ice when its temperature is gradually and continuously lowered. The musical analogy derives from a theory of musical perception that treats melodies strictly as contours or shape morphologies. The compositional process is sensitive to sudden changes in perception occurring when one thing stops sounding like where it came from and starts sounding like where it's going. While *Melody Set 1* presents the smoothest possible trajectory of one melody bending into the forms of another, *Melody Set 2* contrasts this with some of the most complex. Sudden melodic transitions are common. To complement this, changes in the electronic synthesis engine are less frequent.

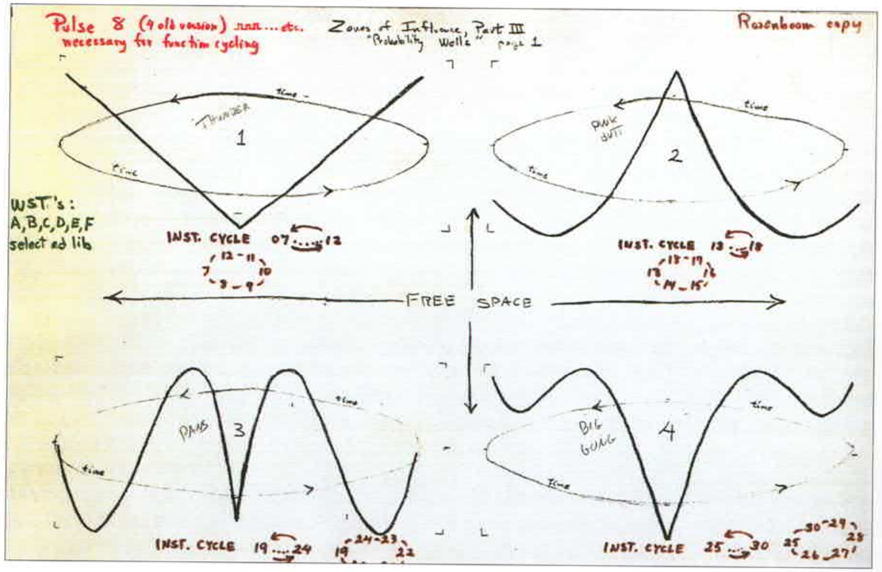
The counterpoint system of *Melody Set 2* is also more thick and tangled than *Melody Set 1.* Eight lines of electronic counterpoint are generated from four trajectories of 6 melodies each (24 melodies in all). A solo marimba and xylophone articulate a fifth trajectory. The score employs a technique I call *window improvisation.* A small window scans through each 60-note melody at pre-determined, varying rates. The player improvises patterns with the notes appearing inside the window, maintaining their ordering. The size of the moving window may vary from two to ten notes. Dynamics, tempi, and all pitches are specified. The marimba and xylophone are treated as one large instrument, and their acoustic signal is parsed into eight frequency ranges. Activity in these ranges is analyzed, and the results drive the propositional model, which in turn drives the sound synthesis engine. In addition to generating single notes, the model also generates bursts of notes at specific speeds, complementing the *window improvisation* of the player.

Part III: *Given the Senses the Real Pregeometry*

Part III explores in musical metaphor a process through which the universe may learn to perceive its own existence. Its score is largely imbedded in the software of the propositional model. The percussionist uses his senses, with some help from graphic diagrams, to discover the form of this algorithmic score, which is analogous to the *pregeometry* or the given order of the universe. He does this by initiating actions with his instruments, which may or may not trigger responses in electronic sound. His actions can also modify the score, just as an observer imparts influences on that which is observed. This model assumes that reality (the order of the piece) is the product of a consciousness (the percussionist) interacting with its environment (the electronic sounds); that the currency of reality is information flowing in both directions between the consciousness and the environment; and that theories or assumptions about reality reflect as much the characteristics of consciousness as their relevance to the nature of the universe, to the process of consciousness perceiving itself and, ultimately, to the universe perceiving its own existence.

Principles from quantum mechanics guide the musical structure as well. A set of *probability waves* expresses the likelihood of the percussionist's actions being followed by sonic responses. These *probability waves* influence the potential match between that *given by the senses* and that *given by the pregeometry.* A harmonic series of probability waves makes a kind of *stochastic key.* The musical experience involves the audience observing the percussionist learning to play *in tune* with this probabilistic harmony in order to establish a close binding between his sounds and the electronic sounds.

These probability waves are scanned cyclically.[3] When the percussionist activates a sensor, the value of a corresponding probability wave at the current point in its cycle is retrieved. If the activation coincides with a peak or relative high point in the wave, the likelihood of the percussionist's action generating a change in the sound synthesis algorithms is high. Otherwise, it is low. The percussionist learns to feel the probability rhythms imbedded inside the software-based score and interacts with them. This is reminiscent of how, in the quantum



world, the positions of charged particles can only be described with probabilities that *collapse* into *knowable* outcomes only when an experimenter interacts with them by taking measurements. In *Zones of Influence*, the percussionist can only come to *know* the system by initiating actions with his instruments.

An auxiliary keyboard player provides additional musical material affected by the percussionist's actions. The score gives eight trajectories of pitch material, again all derived from transformations of the *Origin* and *Target Melodies.* The trajectories vary in length from two melodies to four, making 20 melodies in all. The keyboardist works his way through them in a manner similar to the *window improvisation* of Part II, with somewhat more freedom, but with general directions for speed, temporal density and the lengths of note groups. These notes are further parsed into eight ranges. Activity in these ranges drives another eight-part counterpoint texture generated from eight additional trajectories of mutated melodies, producing 19 more. That makes 39 melodies in Part III. Bursts of notes from the melodies may also emerge as a result of the keyboardist interacting with the same probability rhythms. Though the keyboardist performs music from the score, he never knows what the resulting sounds will be. That is because the percussionist's interaction with the probability rhythms determines which synthesis algorithms will be activated at any time, and these can change rapidly.

Several other ideas from quantum theory also inspired musical analogies in Part III. The *indistinguishability principle* leads to the idea that entities with contrasting vectors (particles with anti-parallel spins) form the tightest bonds with each other. This binding of contrasting phenomena is considered to be a basic principle of nature and also guides the musical metaphor. The idea of a *continuum* in this music is considered to be an illusion and is dependent on one's scale of observation. Consequently, it is assumed that there must be discrete states in macroscopic as well as microscopic phenomena, which are experienced as large-scale *catastrophes.* The assumption follows that changes in morphologies tend to be sudden and are followed by periods of tendency toward stability. The *indeterminacy principle* guides the formation of *musical complementarities* between the percussion and electronic sounds. As particular musical states become defined by probability waves with short wavelengths, their compliments grow more illusive with longer and smoother probability waves.

Part IV: *Epigenesis, Ontogenesis, Phylogenesis, Parthenogenesis*

Part IV is inspired by ideas about evolution and self-replication, on genetic, individual and group levels. These play out in rhythmic patterns and melodic shapes articulated across a drum tarong, a group of drums of graduated pitch, here realized with eight tuned tablas. Transformation algorithms are applied to rhythmic patterns and the contours of movement across the drum tarong. The percussionist's part is completely notated. An auxiliary keyboardist is called for again, this time to play a very simple *pulse melody* made of two sets of eight pitch sequences with four to six notes. To create these, the 60-note *Origin* and *Target Melodies* were reduced to 20 pitches that are particularly important in how their internal phrases move. The keyboardist's task is to keep the beat while the initially simple drum tarong and electronic parts become progressively more complex. The orderings of the short sequences may be freely permuted.

Sensors are attached to the eight drums of the tarong. These drive another eight-voice counterpoint matrix, this time made with transformations applied to the reduced and transposed melody sequences, which are compressed further by mapping them into a quarter-tone pitch space. Each resulting melody trajectory contains nine mutated melodies, making 72 short melodies driven by the percussionist and sixteen played by the keyboardist, 88 in all.

Finally, the score specifies locations where the software begins storing pulses from the drum sensors in an accumulation loop that grows more and more complex as patterns replicate and recombine. Independently, these are recalled and played back through the synthesis engine. This buildup occurs twice, and everything ends in coordination.

Part V: *The Buckling of a Spring*

Poetically, the spring that was wound up in Part I buckles in Part V, releasing a swarm of swirling shapes. All are derived from curves in the probability waves of Part III. In Part V they are applied to every aspect of the synthesis algorithms, in long, short, fast and slow forms, and are notated precisely in a score for two glissando instruments, a continuously gliding tympani roll and swooping pitches on a violin.[4] The violin's sound is parsed into eight frequency ranges. Each time the violin enters into one of these ranges, as it swoops up and down, it triggers a sliding electronic sound in an eight-part counterpoint matrix. The starting pitches for these glides come from more transformation trajectories made with the short melody modules heard in Part IV. This time, there are eleven melodies in each trajectory (88 in all), and they are mapped in both 1/4-tone (24 pitch class) and 1/2-tone (12 pitch class) scale arrangements. They may also be transposed up and down by octaves freely. The starting pitches for each violin glissando also articulate a trajectory of seven melodies, which may be doubled by an extra electronic voice made with synthesis algorithms specified in the score. Ten synthesis algorithms, all based on non-linear wave shaping with time-varying parameters derived from the probability waves, are grouped into two cycles of five. Alternate voices in the counterpoint matrix trigger changes around these two cycles, creating a constantly shifting sonic cosmos. At least two algorithms, one from each cycle, always sound at once. A scale of speeds from very slow to very fast is also specified. To ground and restart our perceptions, two contrasting elements punctuate this cosmos. First, knocks and clangs of wood and metal slice unpredictably through the gliding swarms, like whacks from a Zen master's stick, lest mindfulness escape us into open sonic space. Second, the glissando instrument and percussion—here played by violin and glockenspiel—interrupt half way through, injecting brief bursts of notes scurrying around the set of melody modules originally heard in the pulse-keeping line of Part IV. After that, the swarming sonic cosmos returns for a while before eventually swirling off into distant space.

Study for 'ZONES'

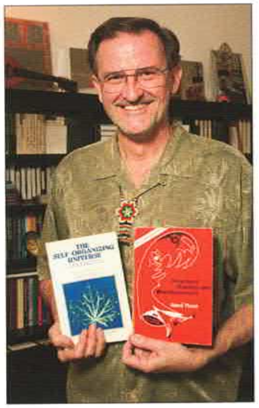
In August 1984 I was commissioned by the Ontario Science Centre in Toronto to make a piece during a residency in a computer music studio set up so that museum goers could watch me working. Periodically, I would stop and explain what I was doing. This took place soon after the introduction of MIDI (Musical Instrument Digital Interface), and a collection of early MIDI synthesizers, samplers and drum machines were assembled for me to use—(as I recall, these were from E-mu, Sequential Circuits, Roland, Akai and Yamaha). I was also provided an Apple II computer running a very early MIDI sequencer program—(possibly from Passport Designs). I was already in the early stages of imagining the propositional models for *Zones of Influence*, and I used this opportunity to experiment with the melody transformation algorithms. I had composed the *Origin* and *Target Melodies* and written some software tools, with which I created a trajectory of mutated melodies. Subsequently, these were loaded into the sequencer program on the Apple II. *Study for 'ZONES'* was then constructed by orchestrating the melody mutations appearing along the trajectory's path in alternating styles, a rhythmical texture contrasting a pointillistic one. The *Origin* and *Target Melodies* also appear at the beginning and end, orchestrated for a grand synthesizer ensemble.

History

Zones of Influence was written during 1984 and 1985 for virtuoso percussionist, William Winant, when we were both working at Mills College in its Music Department and Center for Contemporary Music. Winant has been a frequent musical collaborator since the late 1970s. We premiered the various parts of *Zones of Influence* in succession, as they were completed, and subsequently performed them all in many concerts in the U.S. and Canada for about ten years. The interactive technology required to realize *Zones of Influence* has evolved through several iterations. For this recording, it has been recreated again in its most thorough realization to date.

All electronic sounds heard in *Zones of Influence*, with the exception of signal processing applied to the marimba in Part IIa, were generated by means of digital, non-linear wave shaping techniques. This powerful and efficient synthesis method lay at the heart of an early, digital keyboard instrument developed by Donald Buchla and myself at Buchla and Associates in Berkeley, California in 1979, called the Touché. *Zones of Influence* was initially composed for this instrument. I wrote software for controlling the Touché, called FOIL (Far Out Instrument Language). To make *Zones of Influence*, I also wrote an early version of a toolkit for real-time composition algorithms, called HMSL (Hierarchical Music Specification Language), which ran on the Touché's internal computer, a Texas Instruments 9900. I specified prototypes for data structures, called *elements*, *shapes* and *collections* and implemented a *perform system*, a programmable *stimulus-response environment* in which software objects could be scheduled in time, much like the *players* and *jobs* in later iterations of HMSL. This early version of HMSL generated data to drive FOIL.[5] The Touché was created before the advent of MIDI (Musical Instrument Digital Interface), and with the help of Toyoji Tomita, I designed and built a hardware interface to couple sensors placed on percussion instruments with the Touché. Near the end of the 1980s, composer-programmer, Robert Marsanyi, helped translate the *Zones of Influence* software into a then current version of HMSL, so that it could be played with MIDI instruments. For this new recording, I made a third translation utilizing Reaktor CORE software. With the help of music technologist, Martijn Zwartjes, a new synthesis instrument was created, also based on non-linear wave shaping, which I call Touché II. This new instrument benefits from modern computing speed and power, significantly expands the design concepts of the original Touché, and makes live performances of *Zones of Influence* more practical.

DR September 8, 2013



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[1] I have often been inspired by French mathematician and thinker, René Thom's writing about form, change and catastrophe theory, as in his book, Structural Stability and Morphogenesis.

[2] The term *holarchy* is used to refer to structures that have both top-down and bottom-up dynamical aspects.

[3] The shapes of these probability waves, considered as *eigenfunctions*, are made with Laguerre polynomials.

[4] The score calls for any instrument capable of making continuous glissandi over the pitch ranges shown.

[5] Later, my colleagues, Phil Burk and Larry Polansky, joined in to greatly expand HMSL, which was subsequently widely distributed.

Bios

David Rosenboom (b. 1947) is a composer, performer, interdisciplinary artist, author and educator known as a pioneer in American experimental music. During his long career, he has explored ideas about the spontaneous evolution of musical forms, languages for improvisation, new techniques in scoring for ensembles, multi-disciplinary composition and performance, cross-cultural collaborations, performance art and literature, interactive multimedia and new instrument technologies, generative algorithmic systems, art-science research and philosophy, and extended musical interface with the human nervous system. He holds the Richard Seaver Distinguished Chair in Music at California Institute of the Arts, where he is Dean of The Herb Alpert School of Music and serves as a member of the Center for New Performance. He taught at Mills College from 1979 to 1990, where he held the Darius Milhaud Chair and was Professor of Music, Head of the Music Department, and Director of the Center for Contemporary Music. In the 1970s he was founding faculty and a professor in the Music Department at York University in Toronto. He studied at the University of Illinois in the 1960s with Salvatore Martirano, Lejaren Hiller, Kenneth Gaburo, Gordon Binkerd, Paul Rolland, Jack McKenzie, Soulima Stravinsky and others and was later awarded the George A. Miller Professorship as a visiting artist there. He has also taught or held positions in the Center for Creative and Performing Arts at the State University of New York at Buffalo, at Bard College, Simon Fraser University, San Francisco Art Institute, California College of Arts and Crafts, Center for Advanced Musical Studies at Chosen Vale and Ionian University in Greece. His work is widely presented around the world. Website: http://www.davidrosenboom.com

William Winant (b. 1953) is a multi-faceted percussion artist, who has performed with some of the most innovative and creative musicians of our time, including John Cage, Iannis Xenakis, Anthony Braxton, James Tenney, Cecil Taylor, George Lewis, Steve Reich, Frederic Rzewski, Joan LaBarbara, Yo-Yo Ma, Mark Morris, Mike Patton, Takehisa Kosugi, Christian Wolff and many others. Composers who have written for him include John Cage, Lou Harrison, John Zorn, Alvin Curran, Chris Brown, David Rosenboom, Larry Polansky, Gordon Mumma, Alvin Lucier, Terry Riley, Fred Frith and Wadada Leo Smith. He is principal percussionist with the San Francisco Contemporary Music Players and has been featured as a guest artist with many important groups, including Los Angeles Philharmonic, San Francisco Symphony, Berkeley Symphony, Cabrillo Festival Orchestra, Philharmonia Baroque, Merce Cunningham Dance Company, Oingo Boingo, Kronos Quartet, Sonic Youth, Mr. Bungle and in numerous projects with New York composer, John Zorn. He appears regularly on festivals worldwide and can be heard on many recording labels. He teaches at the University of California at Santa Cruz, Mills College and the University of California at Berkeley. From 1984 to 1992 he was Artist in Residence at Mills College with the critically acclaimed Abel-Steinberg-Winant Trio, which premiered and recorded many new works for violin, piano and percussion. Also at Mills College in the 1980s, he and colleagues, David Rosenboom and Anthony Braxton, formed the innovative performer-composer group, Challenge, which performed widely and released several recordings. Winant and Rosenboom were also core members of the Maple Sugar performance art collective in Toronto in the late 1970s, when they also worked at York University. Website: http://williamwinant.com

Credits and Acknowledgements

William Winant, snare drums, marimba, xylophone, metal instrument collection, vibraphone, tabla tarong, tympani, wood blocks and *Pink Butt* metalophone

David Rosenboom, composition, Touché and Touché II computer music instruments, real-time interactive composition algorithms, sound synthesis programs, glissando instrument (violin), auxiliary keyboard parts, percussion sensor interface design, and recording production, engineering, editing, mixing and mastering

Tom Erbe, recording engineer for percussion and percussion sensor data. **Sam Torrisi** and **Bob Bellerue**, recording engineering assistants. **Tom Hamilton**, mastering assistance. **Daniel Rosenboom**, audio editing assistant. **Martijn Zwartjes**, Reaktor software development for Touché II. **Robert Marsanyi**, HMSL programming assistant. **Toyoji Tomita**, percussion interface construction assistant. **Donald Buchla**, original Touché instrument design. **Matthew Schickele**, graphic design. **Leon Schneiderman**, *Pink Butt* metalophone design.